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# Overall progress achieved since the United Nations Conference on Environment and Development

## Report of the Secretary-General

## Addendum

## Science for sustainable development*

(Chapter 35 of Agenda 21)

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## INTRODUCTION

1. The present report reviews progress made in the implementation of the objectives set out in chapter 35 of Agenda 21 (Science for sustainable development)[1] taking into account the decisions taken by the Commission on Sustainable Development on this subject in 1995 at its third session.

2. It is no exaggeration to assert that without science, there can be no sustainable development. For many of today's major environment and development concerns, the sciences (including the social and human sciences) are essential in detecting and analysing the problem, in identifying solutions and in ensuring scientifically sound action. This has been particularly evident for the ozone depletion issue, and increasingly also for other issues such as climate change, erosion of biological diversity and water and coastal pollution. In fact, the role of science is evident in all advances that have been made towards sustainable development. In this vein, a critical mass of scientists and engineers is needed in developing and developed countries alike for the development, adaptation and use of environmentally sound technologies and land and water management systems. Science is the basis for sustainable agricultural and industrial development, as well as for meeting the world's increasing energy demand.

3. While there has been an increased recognition of the importance of science and a considerable increase in international planning and coordination to provide the scientific basis for sustainable development, the actual amount of money being spent on scientific activities in a majority of both developing and developed countries has declined since 1992. More generally, in most countries investment in research and development (R and D) is stagnating or even diminishing. The same is true as regards financial support for international scientific cooperation programmes. Many developing countries, in particular the least developed ones, still lack adequate scientific capacity, including a critical mass of qualified scientists in relevant disciplines including engineers. Scientific illiteracy remains a major impediment in developed and developing countries alike for a better understanding of environment and sustainable development problems and for ensuring a full participation of the public at large in finding and supporting solutions to these problems.

## I. KEY OBJECTIVES

4. Guided by the priorities identified in chapter 35 of Agenda 21, and the decisions of the Commission on Sustainable Development at its third session,[2] four key objectives in the field of science for sustainable development need to be addressed:

(a) To strengthen capacity and capability in science for sustainable development, with particular emphasis on the needs of developing countries;

(b) To improve scientific knowledge for the prudent management of environment-development interactions in order to provide for both the daily

needs and the future development of humanity. This objective includes reducing scientific uncertainties and improving long-term predictive capacity;

(c) To foster international scientific cooperation and the transfer and sharing of scientific knowledge;

(d) To bridge the gap between science, the productive sectors, decision makers and major groups in order to broaden and strengthen the application of science.

## II. REPORTING ON AND ANALYSING SUCCESS

### A. Growing international recognition of the role of science in sustainable development

5. The essential role of science in sustainable development has been given wide recognition in the initial implementation of (a) many chapters of Agenda 21, in particular chapters 9 through 22, grouped under the title "Conservation and management of resources for development"; (b) the United Nations Framework Convention on Climate Change,[3] the Convention on Biological Diversity[4] and the United Nations Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa;[5] and (c) the action plans adopted at other major global conferences: Barbados (Programme of Action for the Sustainable Development of Small Island Developing States[6]), Cairo (Programme of Action of the International Conference on Population and Development[7]), Yokohama (Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation, containing the Principles, the Strategy and the Plan of Action[8]), Istanbul (Habitat Agenda[9]) and so on.

6. To take an example, the United Nations Conference on the Sustainable Development of Small Island Developing States (Barbados, April-May 1994) recognized the important role of science and technology in its Programme of Action[6] by including a separate chapter (chapter XIII) on this issue. Moreover, within the topical chapters on such subject areas as climate change and sea-level rise, natural and environmental disasters, management of wastes, and so forth, the need for a strong scientific basis was highlighted.

7. Scientific advisory bodies have been established in support of all of the major environmental conventions listed above. Similarly, the Global Environment Facility has recently reconstituted its Scientific and Technical Advisory Panel. These bodies are essential for providing a sound scientific basis for the future "implementation" of sustainable development in the areas of the conventions and for further bridging the gap between science and decision-making.

### B. Major scientific cooperation programmes are in place

8. A significant accomplishment of the post-United Nations Conference on Environment and Development period has been the consolidation and setting into place of major international scientific programmes addressing several critical

environment and sustainable development issues. A number of these programmes are jointly sponsored by several of the United Nations agencies concerned, as well as by the International Council of Scientific Unions (ICSU), its member unions and its vast network of scientific activities.

9. The World Climate Programme (WCP), for which the World Meteorological Organization (WMO) plays an overall coordinating role, provides an example of enhanced inter-agency cooperation and, to some extent, integration of activities by a number of United Nations agencies and ICSU. In 1993, a special intergovernmental meeting on the "Climate Agenda" was held to determine the WCP response to the United Nations Conference on Environment and Development. As requested by Governments at this meeting, the sponsors of the WCP (WMO, the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and its Intergovernmental Oceanographic Commission (IOC), the Food and Agriculture Organization of the United Nations (FAO) and ICSU) have jointly prepared the Climate Agenda, an integrated framework of international climate-related programmes. The Climate Agenda has been endorsed by the governing bodies of all sponsoring organizations.

10. The relevant organizations, based on decisions of their governing bodies, have also started to develop the scientific foundations for comprehensive global observation systems for the major components of the Earth system: the Global Climate Observing System (GCOS) sponsored by WMO, UNEP, IOC and ICSU; the Global Ocean Observing System (GOOS) sponsored by IOC, WMO, UNEP and ICSU; and the Global Terrestrial Observing System (GTOS) sponsored by FAO, UNESCO, UNEP, WMO and ICSU. Cooperation between the three systems is promoted through a joint Sponsors Group.

11. Also in the area of biodiversity science, a new international cooperation programme has been put into place. Diversitas, a joint programme of UNESCO and ICSU and various bodies of the ICSU family, is addressing key issues identified in chapter 15 of Agenda 21 and the Convention on Biological Diversity.

12. Progress has been made in enhancing collaboration among the natural and socio-economic sciences at national, regional and international levels. Launched by the International Social Science Council (ISSC), the International Human Dimensions of Global Environmental Change Programme (IHDP) has now been joined by ICSU, and this change further strengthens its interdisciplinarity. UNESCO has launched an international scientific cooperation programme in the social and human sciences entitled "Management of Social Transformations" (MOST) whose aim is to enhance the use of social science research in formulating sustainable human development policies.

13. Within the individual agencies and organizations of the United Nations system, including the World Bank, scientific programmes and activities have undergone significant revision and reorientation in order to respond to chapter 35 of Agenda 21 and the conventions. Building upon a long tradition of fostering sustainable development in developing countries, this renewal of priorities and mechanisms has reinforced "research and development" action in sectors such as food, agriculture, fisheries and forestry (FAO), industry (the United Nations Industrial Development Organization (UNIDO)), health and

sanitation (the World Health Organization (WHO)), agrometeorology and operational hydrology, and weather and climate forecasting and services (WMO), as well as broader scientific inquiry in the basic, engineering, social and environmental sciences (UNESCO, United Nations University (UNU)). The Intergovernmental Oceanographic Commission, the International Hydrological Programme (IHP) and the Man and the Biosphere Programme of UNESCO have reoriented their activities in response to the specific chapters in Agenda 21 addressing oceans, freshwater and land resources. All relevant United Nations organizations have enhanced their programmes aimed at strengthening national scientific capacities in developing countries, generally with particular attention to Africa south of the Sahara. In the same vein, the regional commissions have also developed their programmes that focus on strengthening science as related to sustainable development in developing countries. Furthermore, ICSU has mounted a programme dedicated to strengthening scientific capacities in developing countries related to global change research, and a programme on capacity-building in science.

### C. Establishment of scientific assessments as a basis for decision-making

14. The use of scientific assessments of specific environmental problems and their implications for development continues to gain widespread acceptance as a vital support for policy- and decision-making. Through the assessment process, the global scientific community is mobilized to establish the current peer-reviewed scientific knowledge on a specific issue so as to identify major gaps in scientific understanding and to carry out strategic programming of further scientific research.

15. The value of scientific assessments had already been demonstrated prior to the United Nations Conference on Environment and Development, as was evidenced by their input into the formulation of the Vienna Convention for the Protection of the Ozone Layer, its Montreal Protocol on Substances that Deplete the Ozone Layer and subsequent amendments. At the international level, one of the main ongoing scientific assessment programmes is that of the Intergovernmental Panel on Climate Change (IPCC) sponsored by WMO and UNEP. IPCC has proven to be a valuable tool for Governments. Based on its scientific assessments, IPCC has proposed various response strategies to counter the potential impacts of climate change. As IPCC interfaces efficiently with the international scientific community, its framework could serve as a model for similar assessment panels on environment and development. Other international assessments that were completed after the United Nations Conference on Environment and Development include the Global Biodiversity Assessment coordinated by UNEP, to which some 1,500 scientists contributed, and FAO's Report on the State of the World's Plant Genetic Resources for Food and Agriculture based on information provided in 154 country reports. The scientific community also conducted assessments of greenhouse gases (WMO/GAW), global water resources (Administrative Committee on Coordination (ACC) Subcommittee on Freshwater Resources) and the pollution of marine and coastal environments from land-based activities (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection-Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP)).

16. Progress has also been made in important scientific and methodological work on the development of indicators for sustainable development. Scientists have addressed the problems inherent in indicator design. It is noteworthy that an effective dialogue has now been established between the scientists working on indicators, and the policy makers who will need to use them, particularly within the context of the Commission on Sustainable Development (see also the report of the Secretary-General on chapter 40 of Agenda 21 (E/CN.17/1997/2/Add.30)).

### D. Scientific cooperation for capacity-building in developing countries

17. A number of important initiatives have been launched to develop high-level scientific capacities in developing countries (with particular reference to the least developed countries) so as to enable these countries to address local problems and to participate fully in regional and international activities related to important issues such as sustainable water and coastal zone management, global change and the conservation and sustainable utilization of biodiversity. Scientific capacities were a_ o enhanced through the upgrading of electronic communications capability and the renewal and sharing of data information systems. North-South and South-South networking of scientists and institutions of excellence contributed key elements of these activities. International organizations that supported these initiatives included UNESCO, FAO, the Third World Academy of Sciences (TWAS) and the Third World Network of Scientific Organizations (TWNSO) as well as the Global Change System for Analysis, Research and Training (START) of ICSU. The intergovernmental Commission on Science and Technology for Development set up by the Economic and Social Council provides another international expert forum for advice in this area, with the secretariat being provided by United Nations Conference on Trade and Development (UNCTAD).

18. Scientific cooperation is also being fostered at the national and regional levels by academies of science that are developing a growing number of activities that address the scientific underpinnings of Agenda 21 chapters. National academies of science in developed countries are supporting science activities in developing countries and, in this manner, strengthening vital links between the scientific communities of North and South. Scientific capacity-building in developing countries is also supported through projects financed by a number of development cooperation agencies of developed countries.

## III. PROMISING CHANGES

19. Improved cooperation and coordination has been established both among scientific programmes of relevant United Nations system organizations (for example, UNESCO WMO, UNEP, FAO, UNIDO, WHO, the International Atomic Energy Agency (IAEA) and the International Maritime Organization (IMO)), and between them and major non-governmental scientific organizations, notably ICSU, ISSC, the International Council for Engineering and Technology (ICET) and their member unions, the Third World Academy of Sciences, and so on.

20. Modern information and communication technologies hold the promise of bridging the information gap between North and South. Through the Internet, scientists and engineers around the globe can now interact instantly with their colleagues so as to communicate their latest findings. Researchers in the South will increasingly gain access to global databases and interact more effectively among themselves and with colleagues in the North, thereby ending long years of isolation and separation.

21. Efforts to strengthen strategic links among the agricultural, environmental, basic and engineering sciences are gradually making progress. The World Bank is supporting a project that identifies 20 centres of excellence in various regions of the South, in order to promote capacity-building in science and technology according to the priorities of each region and with the commitment of local Governments. Each regional or international centre is expected to encompass a network of national centres aimed at training scientists and promoting research and development. The regional centres will be part of a global network. The backbone of the international network will be the international agricultural research centres of the Consultative Group on International Agricultural Research (CGIAR) (co-sponsored by the World Bank, FAO, UNDP and UNEP). Other intergovernmental organizations with major science programmes, such as UNESCO, UNIDO and WMO, would also be invited to participate, as well as major scientific non-governmental organizations (for example, the Third World Academy of Sciences).

22. At the regional level, promising events included ministerial-level meetings on science and technology such as the Hemispheric Meeting of Ministers Responsible for Science and Technology which was held in Cartagena, Colombia, in March 1996. Having the overall aim of strengthening cooperation in science and technology, the Declaration of Principles and Plan of Action adopted by the Meeting constitute a detailed agenda for addressing regional needs in scientific capacity-building, social development, links with the productive sector, environmental conservation and the use of new information technology. Similar ministerial-level meetings were held in other regions, notably Africa and Asia and the Pacific.

23. "Science" is included as an important stakeholder in national institutional set-ups for promoting sustainable development. In a number of countries, scientists have been incorporated into national coordination mechanisms (national commissions/national councils for sustainable development) in their personal capacities or as ex officio representatives of national scientific institutions.

## IV. UNFULFILLED EXPECTATIONS

24. While there has been growing international recognition of the role of the sciences in sustainable development, there has not been an equivalent increased support at the national level. The information available from countries, including that submitted by national Governments to the Commission on Sustainable Development, indicates that very few countries have taken specific measures in direct response to chapter 35 of Agenda 21. In many countries, there is still a lack of clearly defined national strategies, policies and plans

for the purpose of ensuring the development of scientific capacity for the benefit of sustainable development, the management of science, the integration of science in national development plans and national participation in high-priority international scientific endeavours. In fact in most countries, investment in R and D is stagnating or even diminishing. While budget shortages explain this major shortcoming to some extent, it is also clear that many Governments accord low priority to investment in science and national scientific capacity-building. This runs counter to all evidence that there is a relation between investments in science and education and the growth of gross national product (GNP) in several countries showing rapid economic growth.

25. Many developing countries, in particular the least developed ones, still lack adequate scientific capacity, including a critical mass of qualified scientists in relevant disciplines. Weak technological infrastructures, a severe shortage of qualified human resources and limited financial means explain in part the persistent nature of the problem confronting many developing countries. This is where national priority-setting and international scientific cooperation are most sorely needed. Without genuine political will on the part of the international community, expressed in the form of cooperative arrangements, through, for example, the United Nations system and its various organizations, these most basic gaps will persist, seriously compromising efforts to move towards sustainable development.

26. Scientific illiteracy remains a major impediment (even in many industrialized countries) to bringing about a fuller appreciation of the complex issues of environment and development. To achieve a satisfactory way of life in the modern world and to participate actively in the pursuit of sustainable development, literacy in science, understood as an everyday working knowledge of the subject, has become as necessary as reading and writing (constituting literacy in the commonly understood sense).

27. Another very unsettling development is the fact that financial support for international scientific cooperation programmes is stagnating or, in some cases, even diminishing. The financing of international scientific programmes such as the World Climate Research Programme (WMO, IOC of UNESCO and ICSU) is provided primarily by national Governments. Quite naturally, Governments give priority to the financing of national activities feeding into these internationally mandated and coordinated programmes. As a result, it is often difficult to raise funds for the international coordination efforts within each programme and for true international cooperative activities, in particular those supporting developing-country participation in these activities. Governments should realize that internationally coordinated scientific programmes need to have sufficient international "core funding" in order to work efficiently as true programmes.

## V. EMERGING PRIORITIES

28. Strong and concerted international support to build up the scientific community and scientific infrastructures in developing countries, and in particular in least developed countries, is an urgent requirement. Without an endogenous scientific capacity and infrastructure, development is impeded. As

the global nature of environmental issues is increasingly recognized and as government awareness of the interlinkages between development and environment grows, it becomes equally apparent that scientific capacity must be reinforced in all parts of the world and in a broad range of disciplines. Each country must possess the scientific capability to be an active and independent participant in "environment and development", and to master its own understanding of trends, potentials and threats inherent in change on a global scale. In the majority of developing countries today, however, scientific capacity falls far short of this objective.

29. To enhance scientific knowledge and increase scientific capacity with respect to the priority issues identified by the Commission on Sustainable Development (changing consumption and production patterns, energy (including renewable forms), transport, urban issues, enterprise, freshwater, management of risks), Governments, the scientific community and funding organizations should devote special attention to scientific activities relating to these fields. In the field of renewable energy, there is a need for enhanced research and capacity-building, including through the implementation of the relevant components of the World Solar Programme launched by the World Solar Summit at Harare in September 1996.

30. Scientific assessments have proved to be effective mechanisms for assuring quality scientific inputs to decision-making processes on a wide variety of environmental issues. Strong support should be provided for optimal utilization of existing assessment mechanisms and, where appropriate, additional such processes should be set into place. The science of assessment should be further developed in order to provide a sound scientific basis for encompassing an increasingly broad array of factors not only from the biophysical domain, but also from that of socio-economics. Enhancement of predictive capacity through modelling and scenario development is yet another priority area for science. The participation of experts from developing countries, which requires particular financial report, should be increased.

31. Worldwide accessibility to scientific information should be regarded as the birthright of all of the world's citizens and, in particular, should be readily available to scientists in all countries. New information systems and communication technologies hold the promise of offering rapid and worldwide access to scientific resources, but it will be a major challenge to convert this promise into reality. The investment in telecommunication systems and networking services that is required to provide open access to these electronic networks is currently well beyond the reach of some developing countries, particularly the least developed countries. Immediate and concerted action is needed in those cases to prevent the widening of the already substantial information and communication gap with respect to the more advanced countries.

32. Science education, in the larger sense of the term, should be reinforced in all school curricula and at all levels of society. There persists a widespread tendency to see science as the preserve of an intellectual elite, as an acquisition accessible only after years of study. Yet thinking in terms of cause and effect, process and innovation has widespread application to problems of development and sustainability for all members of society. The intellectual tools and approaches of science should be made accessible in all countries, and

to all levels of the population, in order to allow all persons to be active participants in finding solutions to environmental problems and defining appropriate forms of sustainable development. Activities aimed at strengthening science education at national and international levels are ipso facto related to the broader issue of education, awareness-raising and training for sustainable development (see report of the Secretary-General on chapter 36 of Agenda 21 (E/CN.17/1997/2/Add.26)) and should be developed through close cooperation between scientific and educational institutions and departments.

33. Along similar lines, efforts should be continued to promote recognition of the validity and utility of traditional or local knowledge of the natural environment. These vernacular systems of environmental knowledge constitute parallel bodies of knowledge and know-how which can complement scientific knowledge and technology. As they are already an integral part of the socio-economic and cultural lives of communities, they provide a grass-roots base for conservation and sustainable development action which can be accessed through participatory research methods.

34. As regards the lack of funds allocated to science and science education, appropriate measures must be taken to increase investment in R and D at the national level, with a focus on science for sustainable development, in developing countries and developed countries alike. Support to developing countries, in particular least developing countries, to strengthen their scientific infrastructure and capacities, is one of the highest priorities facing society today. Multilateral and bilateral donor agencies and Governments, as well as specific funding mechanisms, such as the Global Environment Facility, in relation to the four core areas, should step up significantly their support to developing countries in this regard. Special attention should also be paid to providing sufficient "core-funding" to the secretariats of recognized international scientific cooperation programmes in key areas of environment and sustainable development.

35. Some other issues that will require increased research activities in the future are related to (a) the pathways of man-made chemicals, in particular toxic chemicals, in ecosystems, agro-ecosystems and the global biosphere and the possible undesirable biological effects in humans and animals subsisting often far away from the source point; and (b) interdisciplinary research on re-emerging tropical and subtropical diseases conditioned by particular environments and vectors.

## Notes

[1] Report of the United Nations Conference on Environment and Development, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

[2] See Official Records of the Economic and Social Council, 1995, Supplement No. 12 (E/1995/32), chap. I, sect. C.2, para. 152.

[3] A/AC.237/18 (Part II)/Add.1 and Corr.1, annex I.

[4] See United Nations Environment Programme, Convention on Biological Diversity (Environmental Law and Institutions Programme Activity Centre), June 1992.

[5] A/49/84/Add.2, annex, appendix II.

[6] Report of the Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, Barbados, 25 April-6 May 1994 (United Nations publication, Sales No. E.94.I.18 and corrigenda), chap. I, resolution 1, annex II.

[7] Report of the International Conference on Population and Development, Cairo, 5-13 September 1994 (United Nations publication, Sales No. E.95.XIII.18), chap. I, resolution 1, annex I.

[8] Report of the World Conference on Natural Disaster Reduction, Yokohama, 23-27 May 1994 (A/CONF.172/9), chap. I, resolution 1, annex I.

[9] Report of the United Nations Conference on Human Settlements (Habitat II), Istanbul, 3-14 June 1996 (A/CONF.165/14), chap. I, resolution 1, annex II.

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